

Chemistry 30

Diploma Examination Results ✓

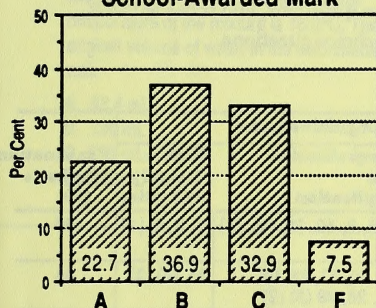
Examiners' Report

January 1992

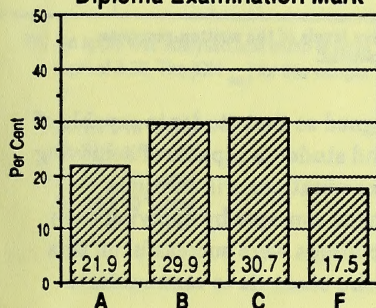
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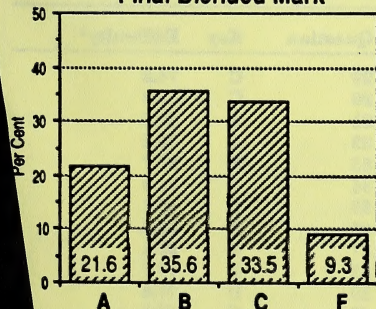
School-Awarded Mark



Diploma Examination Mark



Final Blended Mark



The summary information in this report provides teachers, school administrators, students, and the general public with an overview of results from the January 1992 administration of the Chemistry 30 Diploma Examination. The information is most helpful when used in conjunction with the detailed school and jurisdiction reports that have been mailed to schools and school jurisdiction offices. An annual provincial report containing a detailed analysis of the combined January, June, and August results will be available next fall.

Description of the Examination

The Chemistry 30 Diploma Examination consists of three parts: a multiple-choice section of 42 questions worth 60%, a numerical-response section of seven questions worth 10%, and a written-response section of three questions worth 30% of the total examination mark.

Achievement of Standards

The information reported is based on the final blended marks achieved by 7 462 students who wrote the January 1992 examination.

- 90.7% of these students achieved the acceptable standard (a final blended mark of 50% or higher).
- 21.6% of these students achieved the standard of excellence (a final blended mark of 80% or higher).

Overall, student achievement in Chemistry 30 was acceptable, particularly in their knowledge of core concepts. However, students continued to have difficulty with laboratory-related skills and processes, and in organizing and communicating their chemistry knowledge.

Provincial Averages

- The average school-awarded mark was 66.9%.
- The average diploma examination mark was 65.1%.
- The average final blended mark, representing an equal weighting of the school-awarded and diploma examination marks, was 67.0%.

Students
First!

Student Evaluation

Alberta
EDUCATION

Results and Examiners' Comments

Subtest

When analysing any detailed examination results, please bear in mind that subtest results **cannot** be directly compared.

Results are in average raw scores.

Machine scored: 35.55 out of 49

Written response: 12.1 out of 21

• Course Content

-Chemical Energetics: 13.7 out of 23

-Acids and Bases: 15.73 out of 24

-Oxidation-Reduction:

16.13 out of 23

• Process Skills: 27.01 out of 45

-Multiple-choice questions 3, 5, 7, 9, 10, 12, 15, 16, 17, 22, 23, 26, 27, 28, 33, 34, 35, 36, 38; numerical-response question 3, 4, 5, 6, and 7; and written-response questions 1, 2, and 3.

• Cognitive Levels

-Knowledge: 14.96 out of 19

-Comprehension and Application: 25.17 out of 39

-Higher Mental Activities: 5.44 out of 12

Examination Blueprint

Each question on the examination is classified in two ways: according to the curricular content area being tested and according to the cognitive level demanded by the question. The examination blueprint illustrates the distribution of questions in January 1992 according to these classifications. Numbers with brackets [] indicate written-response questions, those with parentheses () indicate numerical-response questions, and those without brackets or parentheses indicate multiple-choice questions.

Reporting Category	Questions by Cognitive Level			Examination Emphasis (%)
	Knowledge	Comprehension and Application	Higher Mental Activities	
Chemical Energetics	1, 4, 6, 11, 13, 14, (1)	2, 5, 8, 10, 12, (2), [1]	3, 7, 9, [1]	33
Acids and Bases	15, 16, 17, 18, 27, [2]	19, 20, 21, 22, 23, 24, 26, 28 (3) [2]	25, (4) [2]	34
Oxidation-Reduction	29, 30, 32, 34, 37, 38, 42	31, 33, 36, 39, 40, 41, (5) (6) (7) [3]		
Examination Emphasis (%)	29	52	19	100%

Note: For reporting purposes, the three cognitive levels of the written-response section has been combined into one component.

This examination has a balance of question types and difficulties. It is designed so that students capable of achieving the acceptable standard would obtain a mark of 50% or higher and students capable of achieving the standard of excellence would obtain a mark of 80% or higher. Future examinations will continue to require students to demonstrate clarity in their thinking and understanding of concepts by applying their knowledge to new and novel situations. Students who achieved these expectations were successful on this examination. The next series of diploma examinations will continue to require students to communicate their answers in a clear and concise fashion as well.

Multiple Choice

Question	Key	Difficulty*	Question	Key	Difficulty*	Question	Key	Difficulty*
1	A	91.2	15	A	95.5	29	C	74.2
2	C	89.0	16	A	64.7	30	C	80.3
3	B	42.8	17	C	81.7	31	A	50.3
4	C	62.7	18	B	79.2	32	A	79.1
5	A	74.4	19	B	63.5	33	B	83.7
6	B	89.1	20	D	76.8	34	C	71.9
7	A	61.8	21	C	84.5	35	D	66.6
8	C	79.6	22	B	35.2	36	A	59.3
9	B	66.5	23	C	89.9	37	B	92.1
10	D	27.8	24	D	70.5	38	D	70.7
11	B	92.0	25	A	43.6	39	D	77.6
12	D	71.2	26	A	63.3	40	C	75.5
13	C	80.7	27	B	95.2	41	A	81.2
14	D	68.5	28	D	41.9	42	B	77.3

* Difficulty—percentage of students answering the question correctly

For a complete breakdown of student responses by alternative for the multiple-choice questions, please refer to the school and jurisdiction reports.

Multiple Choice

The following questions were selected for discussion because they exemplify what is required to meet the acceptable standard and the standard of excellence.

10. 25.0 g of ice at the melting point are added to calorimeter water at 25.4°C. When thermal equilibrium is reached, the final temperature of the mixture is 15.0°C. The original volume of water in the calorimeter was

A. 93.4 mL
B. 136 mL
C. 209 mL
• D. 228 mL

Question 10: Most students recognized that a change in both kinetic energy and potential energy is involved and, as a result, they could construct/recall the proper algorithm to solve the question. However, all students who did not attain the standard of excellence had difficulty assigning correct values to the algorithm. One problem these students had was recognizing what occurs when a thermal equilibrium is reached. This lack of understanding resulted in 19.1% of the students selecting 15.0°C as the value for Δt for "ice water" and 25.4°C as the Δt for "calorimeter water". A total of 29.8% of the students failed to recognize that when ice melts to liquid water, the specific heat capacity is that of liquid water and not that of solid ice. This result suggests that those students who do not attain the standard of excellence cannot transfer what they see happening in a laboratory context into an algorithm and then solve it correctly.

21. An apple was analysed and found to have a pH of 3.30. The $[\text{OH}^-]_{\text{aq}}$ for this sample is

A. 1.0×10^{-3} mol/L
B. 5.0×10^{-4} mol/L
• C. 2.0×10^{-11} mol/L
D. 1.0×10^{-10} mol/L

Question 21: Most students (84.5%) recognized the relationship between $[\text{H}_3\text{O}^+]_{\text{aq}}$ and $[\text{OH}^-]_{\text{aq}}$ and calculated the correct value. Of the students who answered incorrectly, the most common mistake (13.5%) was the failure to recognize this relationship. This result suggests that students attaining the acceptable standard understand fundamental concepts and are able to solve simple two-step problems involving these concepts.

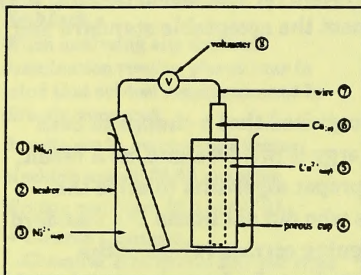
Numerical Response

Almost all students correctly followed the instructions for filling in the answer sheet. Fewer than 10 students wrongly recorded correct answers. These students were not penalized; however, students who did not round their answers as instructed lost marks.

Question	Answer	Difficulty*
1	2, 1, 4, 3	47.1
2	14.8	49.7
3	3, 4, 2, 1,	45.6
4	3.72	55.1
5	1.56	63.1
6	1, 6, 1, 5	29.2
7	73.2	35.1

* Difficulty—percentage of students answering the question correctly

Use the following diagram to answer question 6.



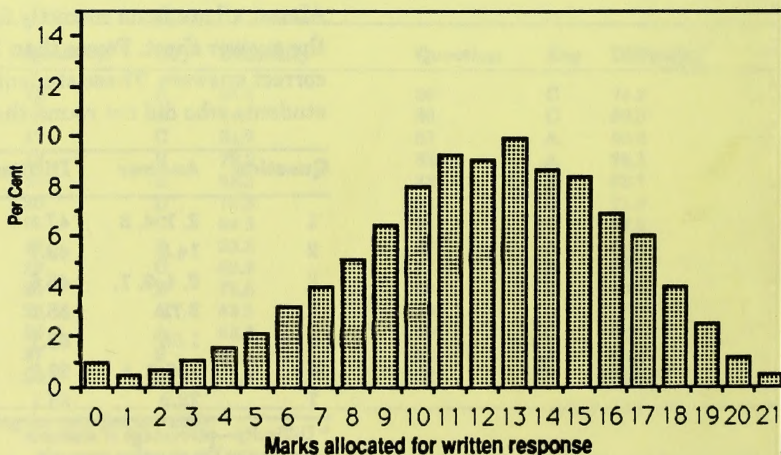
6. When the electrochemical cell is operating, the

- anode is _____ (record in first column)
- cathode is _____ (record in second column)
- reducing agent is _____ (record in third column)
- oxidizing agent is _____ (record in fourth column)

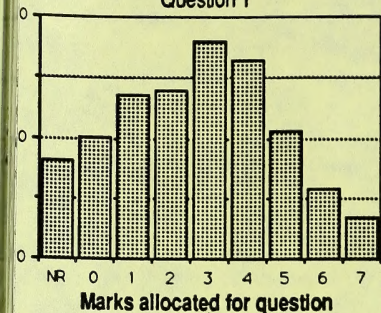
The average for question 6 was 29.2%. The question discriminated well between strong and fairly strong students. The most frequent mistake students (19.0%) made was to select $\text{Ni}^{2+}_{(aq)}$ as the cathode. The next most common mistake (11.4%) arose from the assumption that oxidizing agents are oxidized and reducing agents are reduced. Of this 11.4%, almost two-thirds of the students were able to correctly identify the anode and cathode. The results for this question suggest that students achieving the standard of excellence can successfully extract valid inferences from diagrammatic data.

Written Response

The level of achievement on the written-response section was better than expected: about two-thirds of the students (66.0%) achieved a mark of 11 or higher out of 21. This result was obtained in spite of the fact that students did not perform as well as expected on question 2.



Question 1



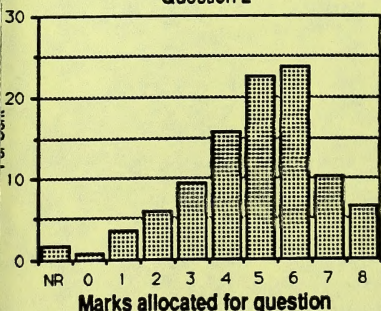
Question 1 was answered better than expected. This question was expected to distinguish between students at the acceptable standard and those at the standard of excellence. Thus, slightly less than two-thirds (63.9%) of the students were unable to solve the question and, as a result, obtained a mark of three or less. This was due in part to the dual purpose of the question: the first purpose was to measure students' ability to write a laboratory procedure, and the second purpose was to test students' understanding of calorimetry and specific heat capacity. A student who did well on only one of these components generally received four marks, but a student who completed both could attain the standard of excellence. Students who did not meet the acceptable standard were unable to address either part of the question. Many tried to measure the metals' heat of fusion or heat of reaction. Most of these students were unable to experimentally determine a specific heat capacity. They had difficulty expressing themselves and, as a result, their responses required interpretation.

Students who attained the acceptable standard but not the standard of excellence often had a good understanding of the concept but lacked organizational skills, or vice versa. These students had great difficulty coming up with a method to measure the initial temperature of the metal. Many of these students arranged their steps in an impossible chronological order. However, these students were generally able to communicate their ideas so that little if any interpretation was required.

Students who attained the standard of excellence identified both components of the question. The error that prevented these students from earning full marks for this question was the failure to determine the highest/lowest temperature reached by the calorimeter. These students presented all their steps in a logical order and expressed themselves clearly so that no interpretation was required by the examiner.

On this 7-mark question, the average mark was 2.71 or 39% of the available mark.

Question 2

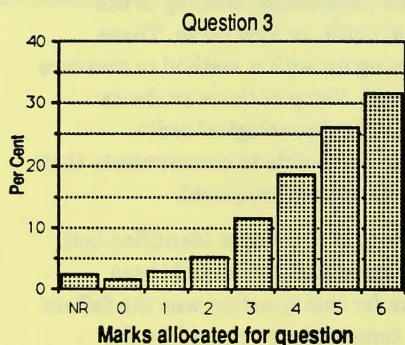


Question 2 was not answered as well as expected. Students who did not attain the acceptable level on the examination were expected to score up to 3 on this question. These students had difficulty in identifying the essential observation and recalling fundamental empirical definitions. Many of these students assumed that there was one of each type of solution and assigned an unknown to each classification, with no attempt at an explanation.

Students who attained the acceptable level on the examination were expected to score 4 or higher on this question; most attained a mark of either 5 or 6. Students correctly identified the nature of each solution and explained how they reached their conclusion. However, they were unable to clearly identify the essential observation that led to each successful identification, and as a result, tended to repeat the observations given in the question rather than analyse them.

Students who attained the standard of excellence on this question were expected to score 7 or 8, and they did. They clearly communicated their understanding of the nature of solutions and were able to discriminate between relevant and irrelevant data. Some of these students went beyond the expectations of the question and correctly identified the strength of the acidic solutions.

On this 8-mark question, the average mark was 4.83 or 60% of the available mark.



Question 3 was answered better than expected. This question was selected to distinguish between students below the acceptable standard and those at the acceptable standard. Students who did not attain the acceptable level on the examination scored 0 to 3. These students had difficulty selecting appropriate half-reactions. Many wrote an unbalanced non-ionic chemical equation involving substances that do not exist. They also had difficulty determining the moles of $\text{AgNO}_{3(aq)}$. Most of these students used the molar mass of $\text{AgNO}_{3(s)}$ to calculate the moles of $\text{AgNO}_{3(aq)}$. In addition, these students appeared not to have a concept of what an observation is.

Students who attained the acceptable level on the examination were expected to score 4 or better. These students used half-reactions to predict the net ionic equation and generally used the correct mole ratio to determine their final answer correctly. They had difficulty giving an observation that was reasonable; many gave a correct statement rather than an observation. These students had difficulty using units, states, and significant digits. In general, the responses by these students were well-written and fairly well-organized.

Students who attained the standard of excellence were expected to score 6 and make no errors, and they did.

On this 6-mark question, the average mark was 4.41 or 74% of the available mark.

For further information, contact Don Loerke, Lowell Hackman, or Phill Campbell at the Student Evaluation Branch, 427-2948.